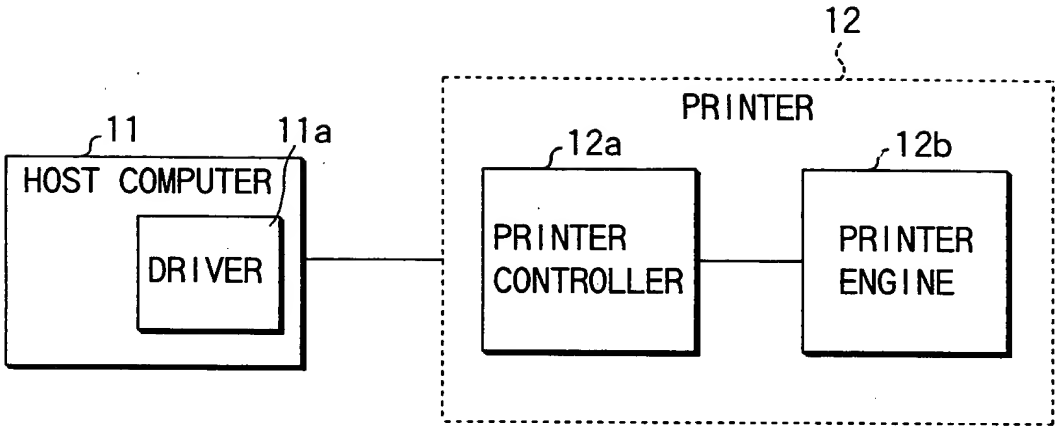

12
PRINTER
11
11a
HOST COMPUTER
DRIVER
12a
PRINTER CONTROLLER
12b
PRINTER ENGINE

FIG. 1

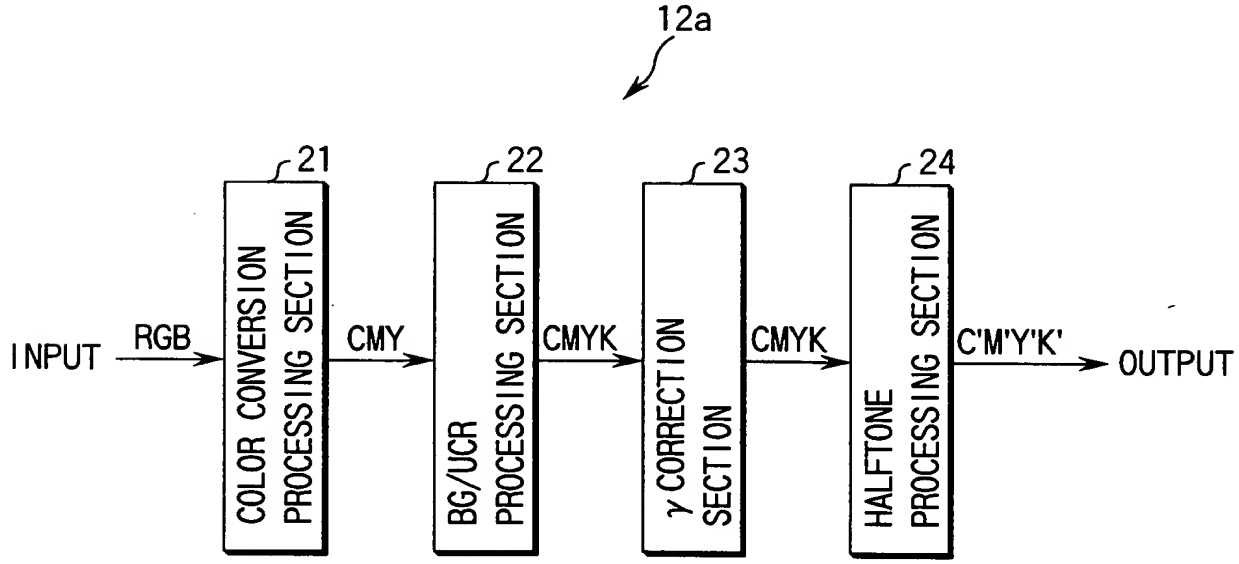

12a
21
22
23
24
INPUT
RGB
COLOR CONVERSION PROCESSING SECTION
CMY
BG/UCR PROCESSING SECTION
CMYK
γ CORRECTION SECTION
CMYK
HALFTONE PROCESSING SECTION
C'M'Y'K'
OUTPUT

FIG. 2

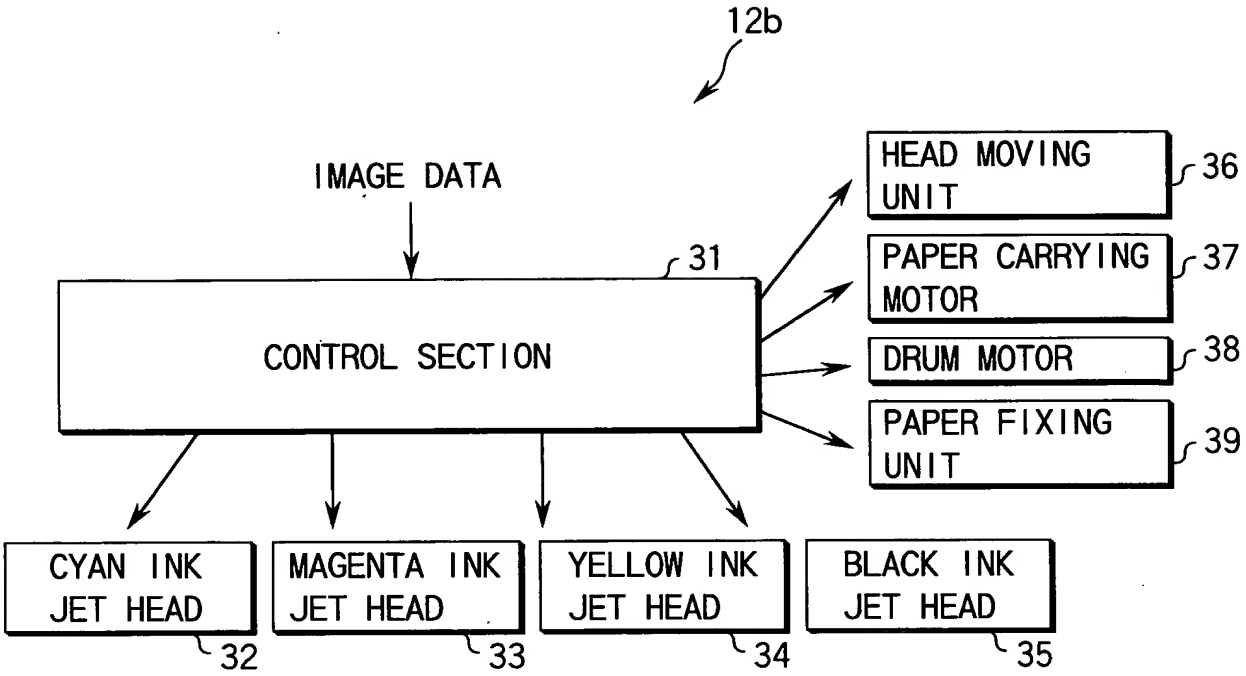

12b
IMAGE DATA
31
CONTROL SECTION
HEAD MOVING UNIT
36
PAPER CARRYING MOTOR
37
DRUM MOTOR
38
PAPER FIXING UNIT
39
CYAN INK JET HEAD
32
MAGENTA INK JET HEAD
33
YELLOW INK JET HEAD
34
BLACK INK JET HEAD
35

FIG. 3

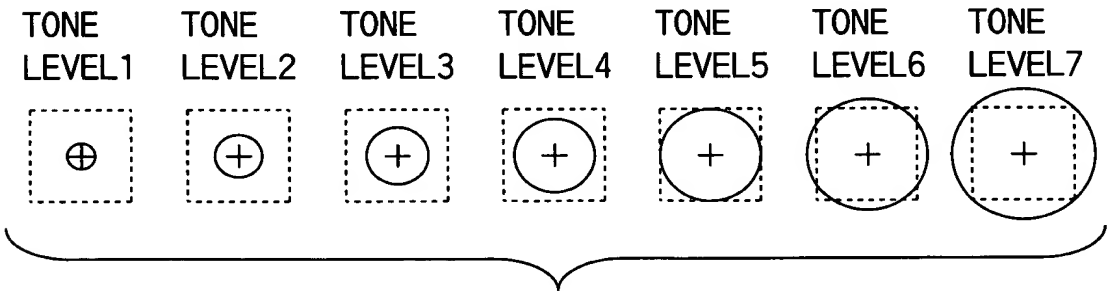

TONE LEVEL1
TONE LEVEL2
TONE LEVEL3
TONE LEVEL4
TONE LEVEL5
TONE LEVEL6
TONE LEVEL7

FIG. 4

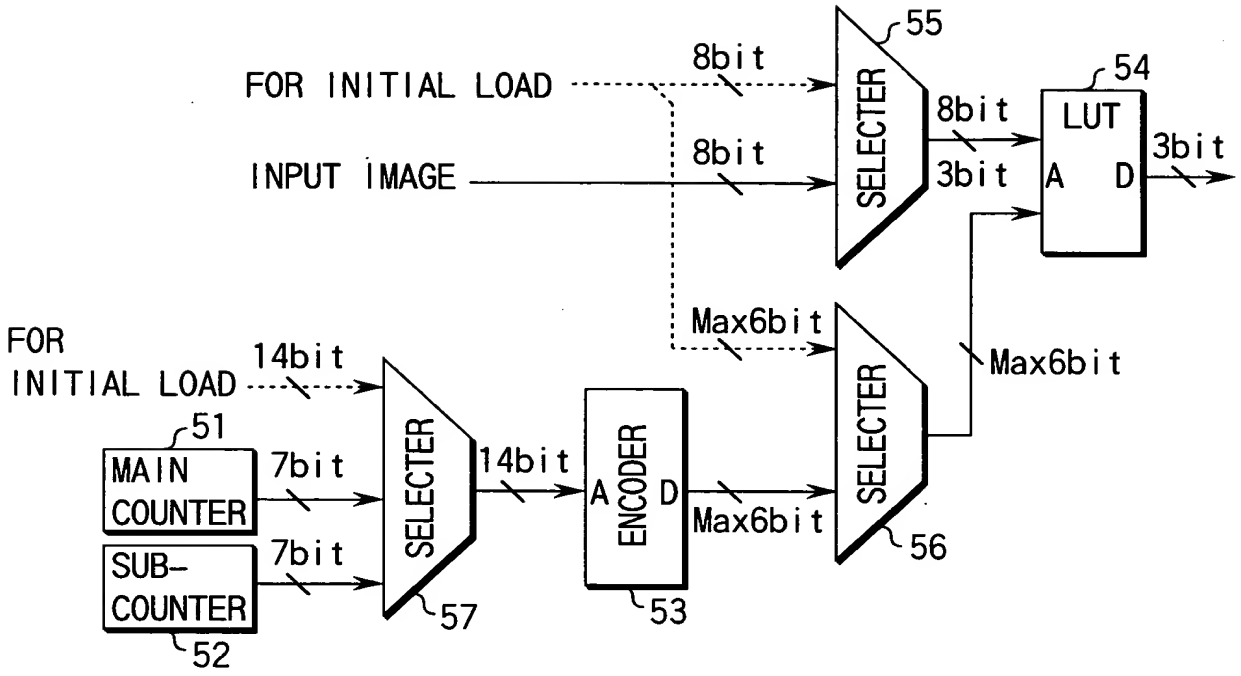


FIG. 5

7	8	5	6
4	1	2	3
5	6	7	8
2	3	4	1

FIG. 6

FIG. 7A

THRESHOLD PLANE \ REFERENCE THRESHOLD	1	2	3	4	5	6	7	8
1	1	2	3	4	5	6	7	8
2	9	10	11	12	13	14	15	16
3	17	18	19	20	21	22	23	24
4	25	26	27	28	29	30	31	32
5	33	34	35	36	37	38	39	40
6	41	42	43	44	45	46	47	48
7	49	50	51	52	53	54	55	56

FIG. 7B

THRESHOLD PLANE \ REFERENCE THRESHOLD	1	2	3	4	5	6	7	8
1	1	8	15	22	29	36	43	50
2	2	9	16	23	30	37	44	51
3	3	10	17	24	31	38	45	52
4	4	11	18	25	32	39	46	53
5	5	12	19	26	33	40	47	54
6	6	13	20	27	34	41	48	55
7	7	14	21	28	35	42	49	56

FIG. 7C

THRESHOLD PLANE \ REFERENCE THRESHOLD	1	2	3	4	5	6	7	8
1	1	2	5	6	11	12	19	20
2	3	4	9	10	17	18	27	28
3	7	8	15	16	25	26	35	36
4	13	14	23	24	33	34	43	44
5	21	22	31	32	41	42	49	50
6	29	30	39	40	47	48	53	54
7	37	38	45	46	51	52	55	56

FIG. 8A

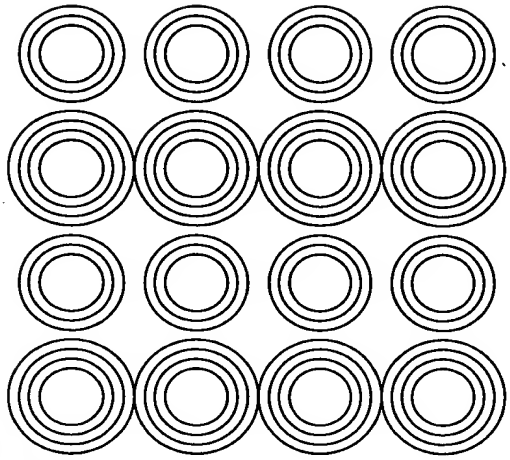


FIG. 8B

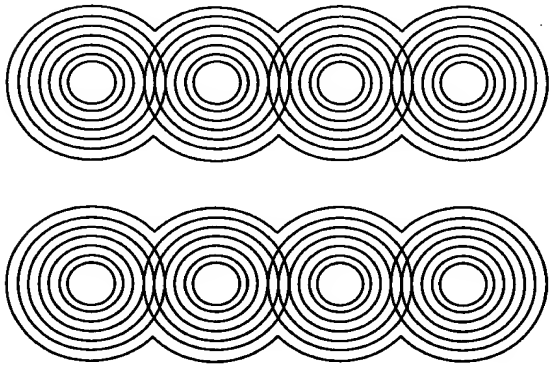
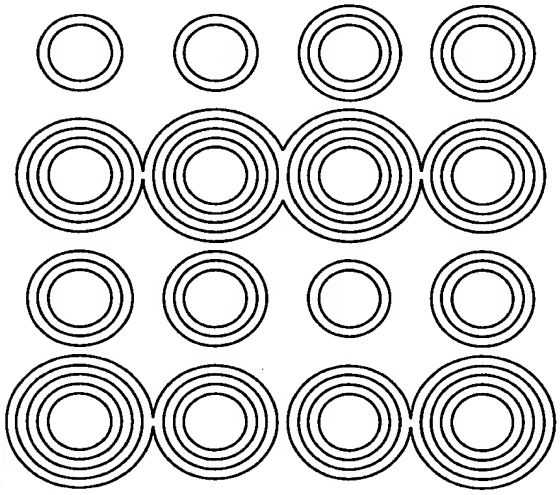


FIG. 8C



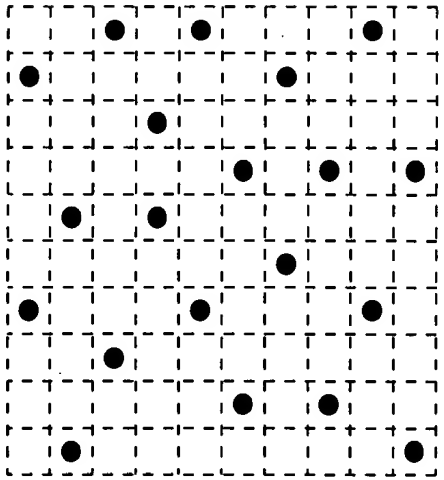


FIG. 9A

FIRST THRESHOLD PLANE PROCESSING

COMPLETION OF FIRST THRESHOLD PLANE

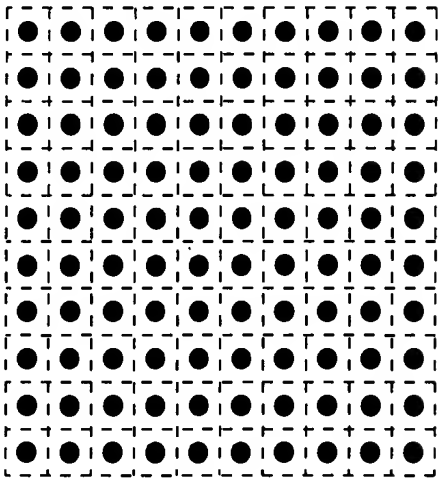


FIG. 9B

SECOND THRESHOLD PLANE PROCESSING

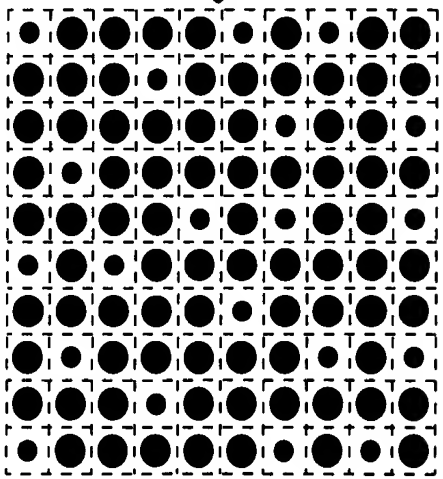


FIG. 9C

COMPLETION OF SECOND THRESHOLD PLANE

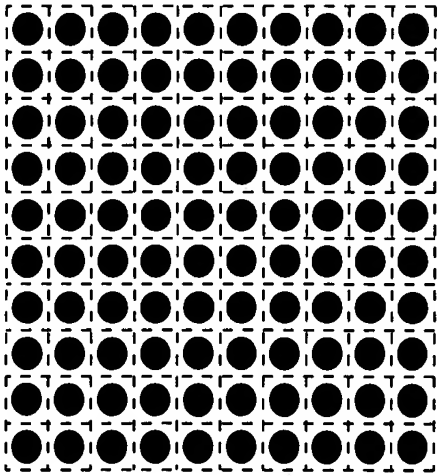


FIG. 9D

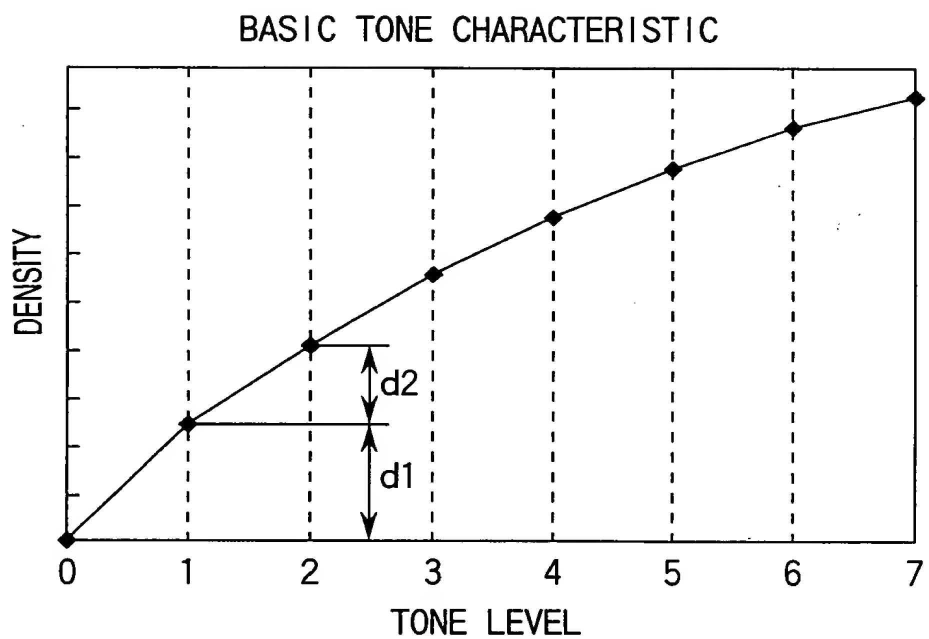

BASIC TONE CHARACTERISTIC
DENSITY
d2
d1
0
1
2
3
4
5
6
7
TONE LEVEL

FIG. 10

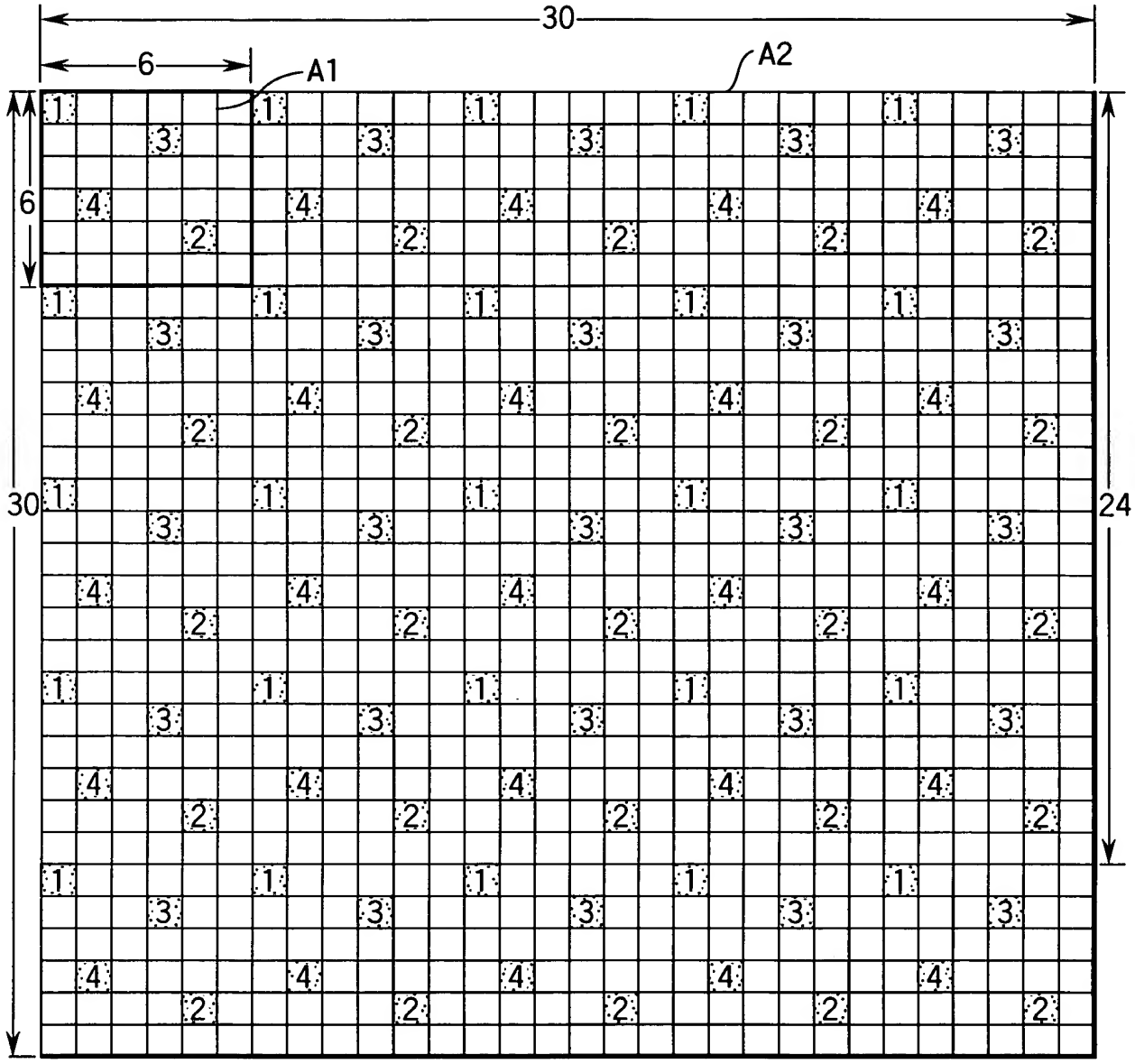


FIG. 11A

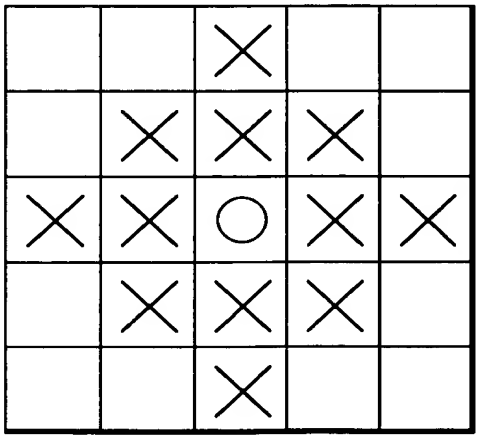


FIG. 11B

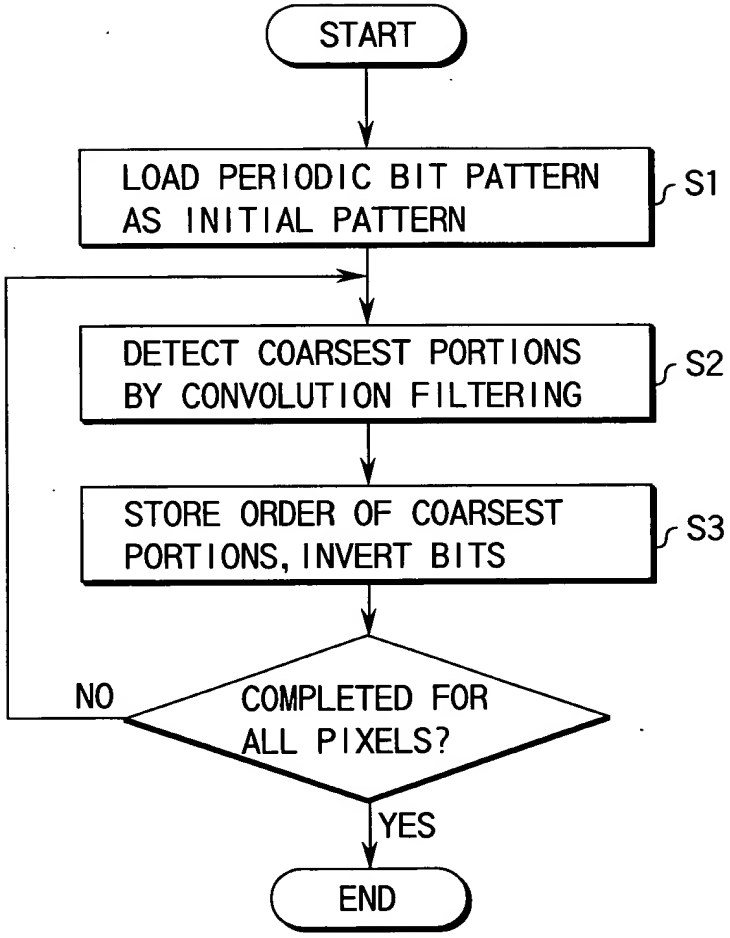

START
LOAD PERIODIC BIT PATTERN AS INITIAL PATTERN
S1
DETECT COARSEST PORTIONS BY CONVOLUTION FILTERING
S2
STORE ORDER OF COARSEST PORTIONS, INVERT BITS
S3
NO
COMPLETED FOR ALL PIXELS?
YES
END

FIG. 12

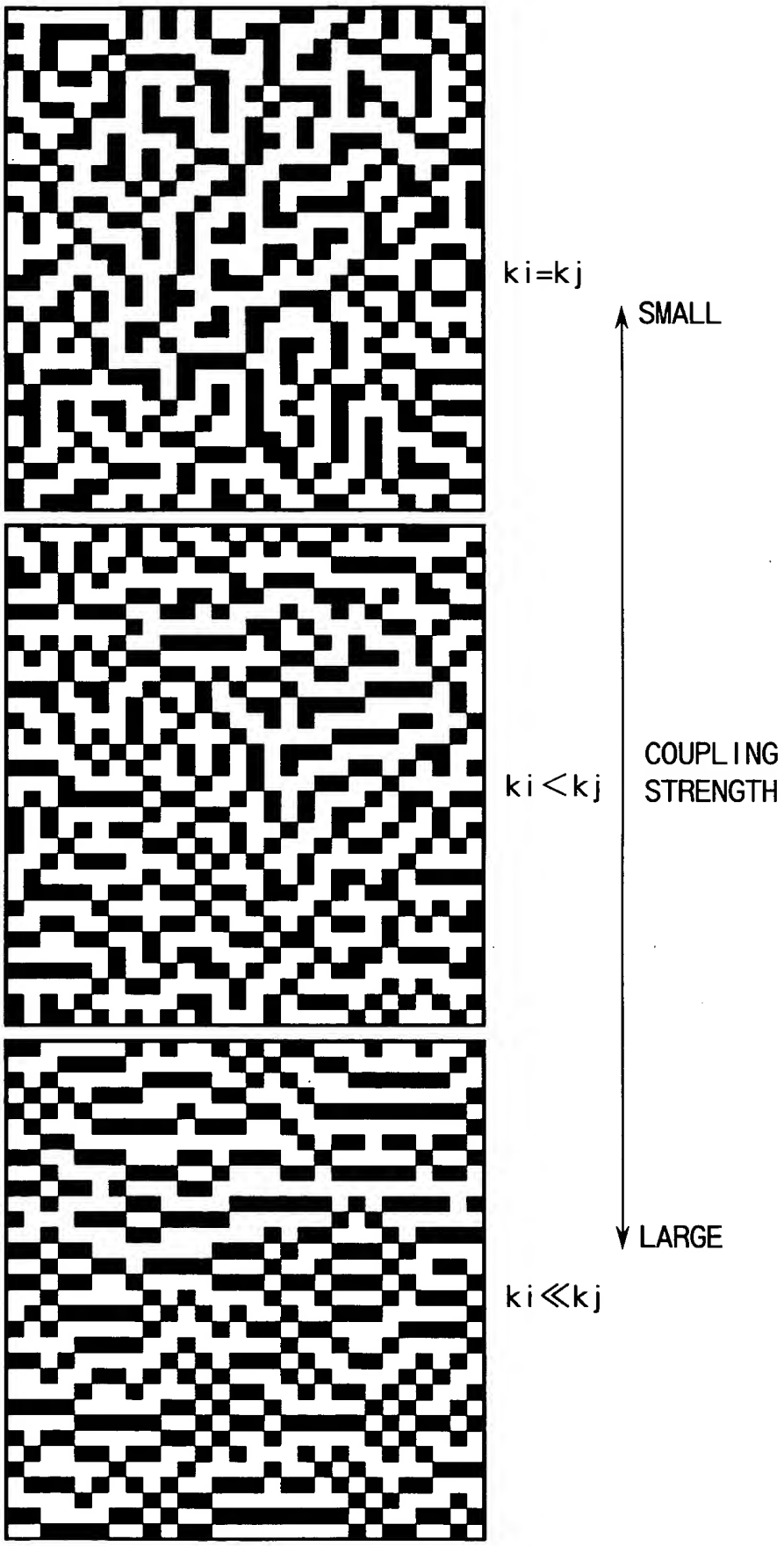


FIG. 13A

FIG. 13B

FIG. 13C

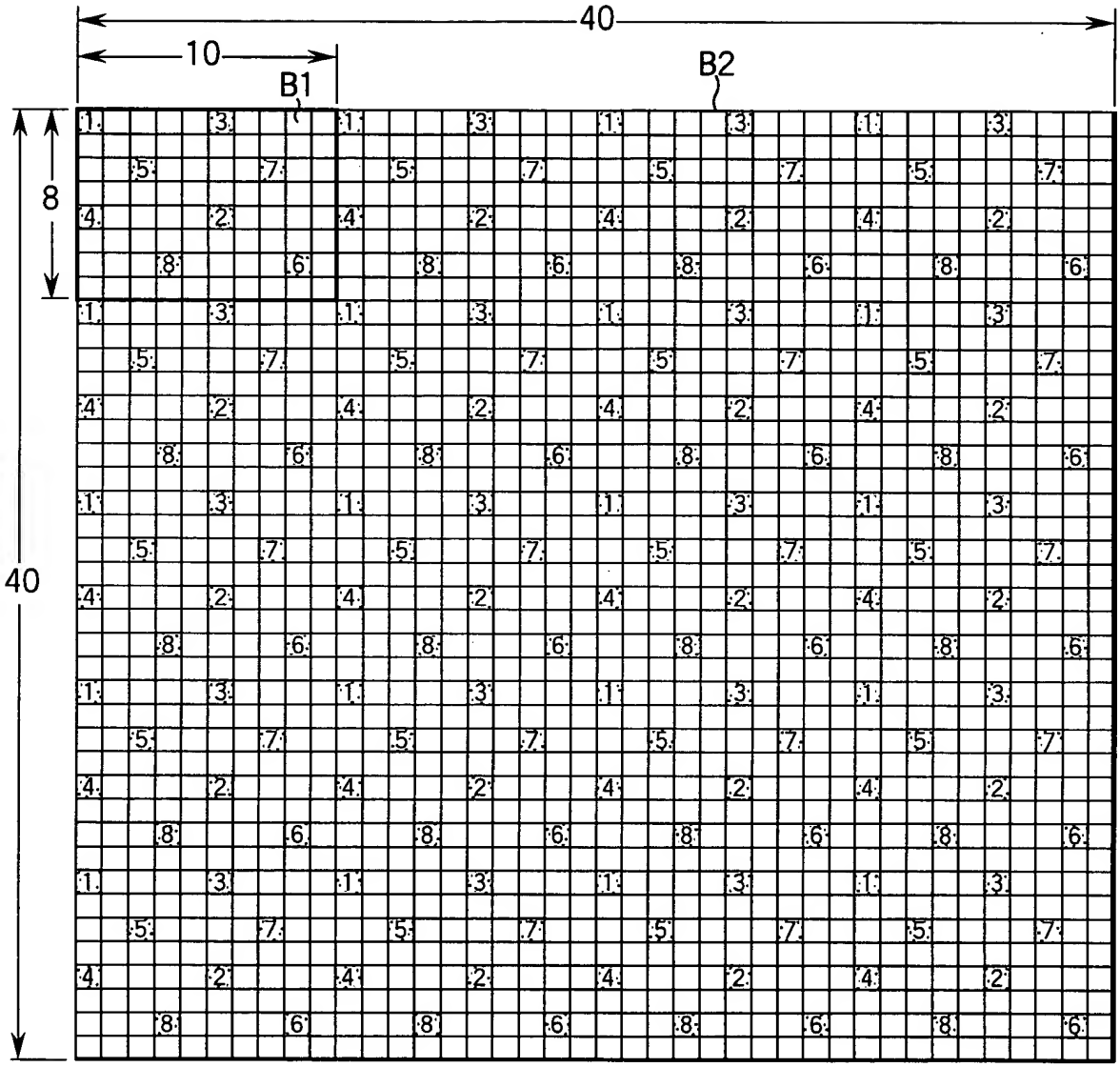


FIG. 14

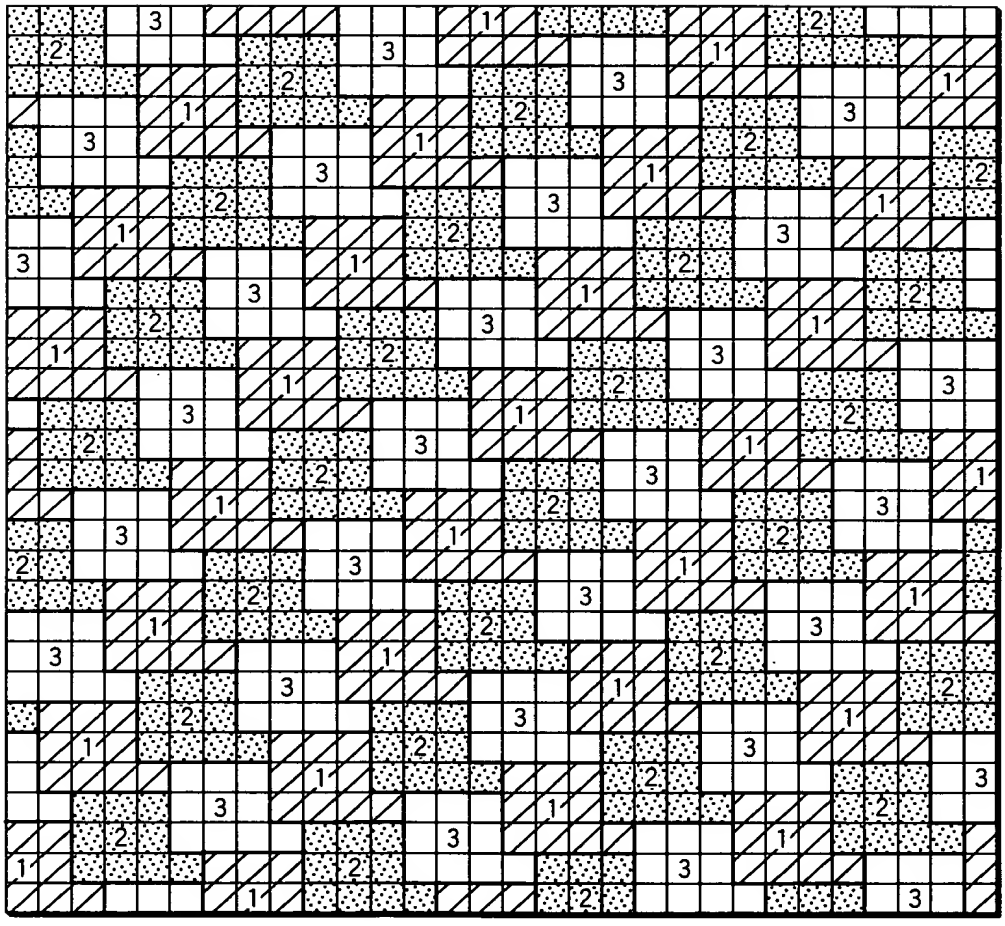


FIG. 15

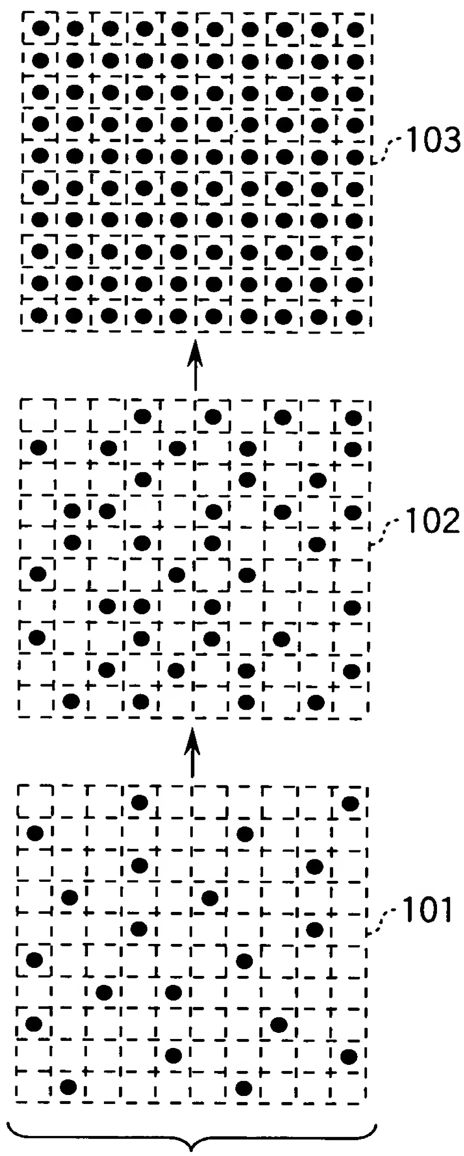


FIG. 16A

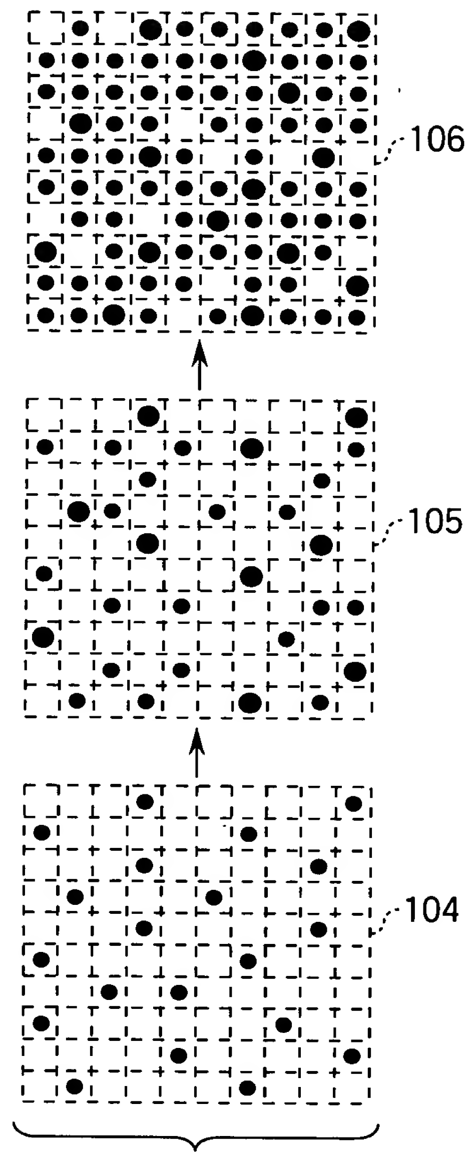


FIG. 16B

FIG. 17A

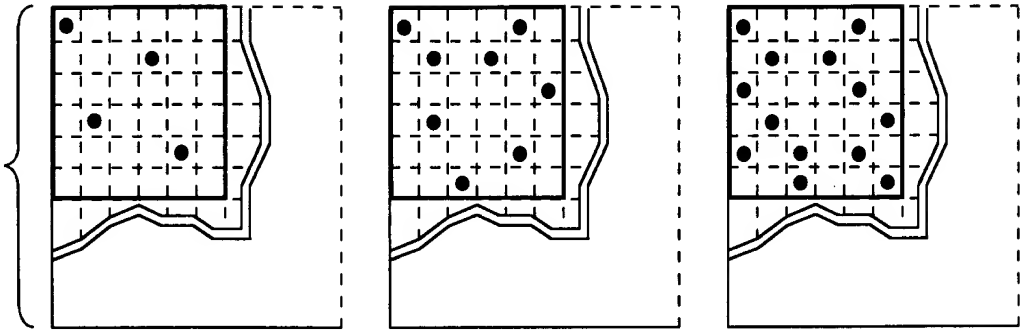


FIG. 17B

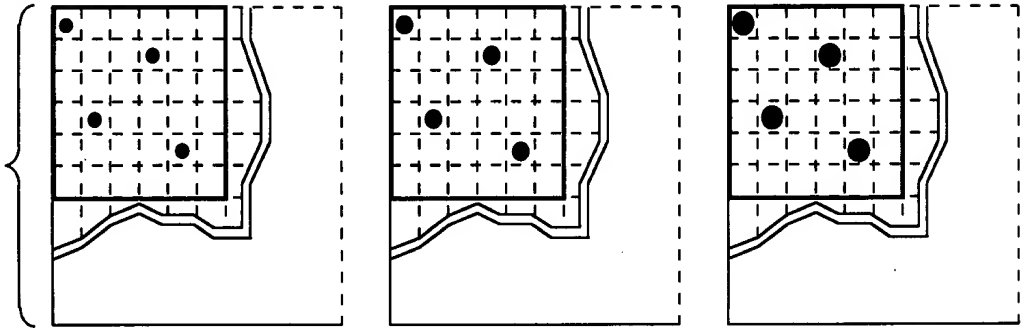


FIG. 18

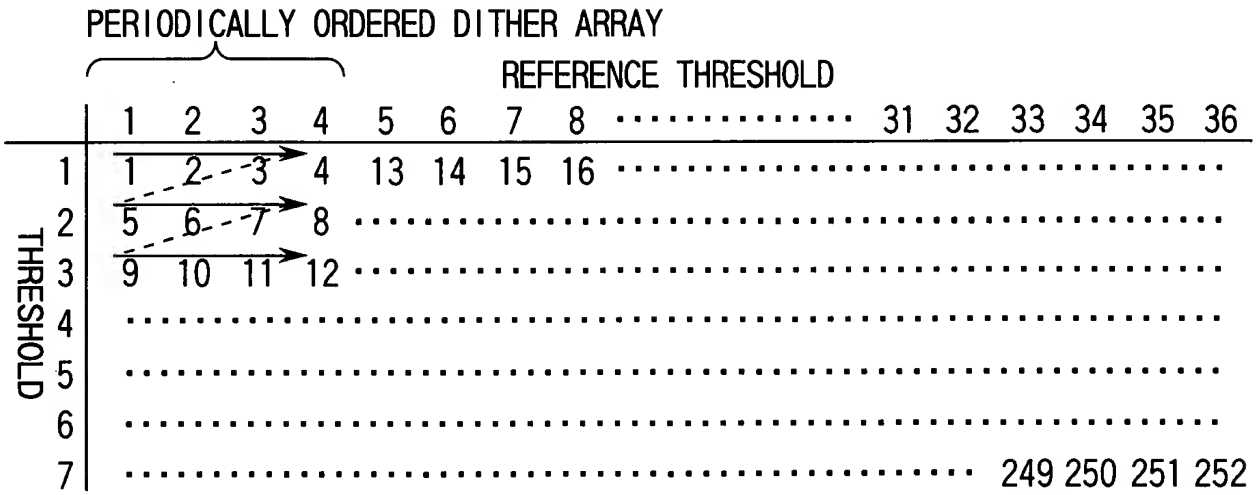


FIG. 19A

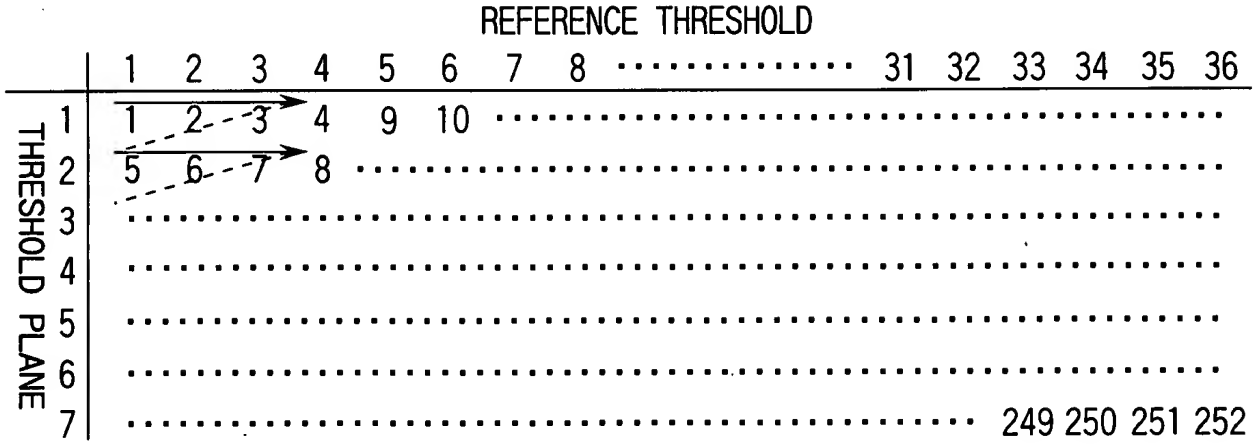
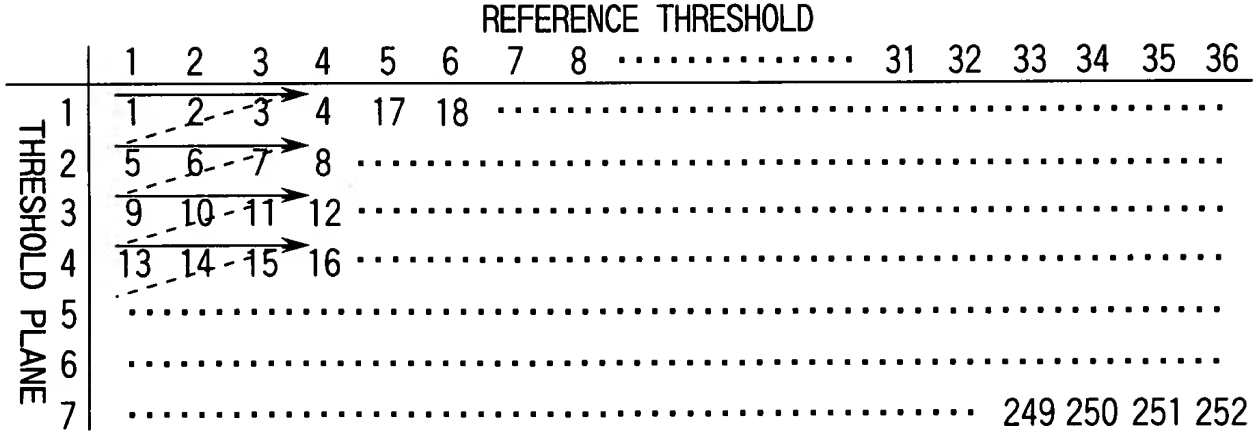


FIG. 19B



REFERENCE THRESHOLD

THRESHOLD PLANE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
2	37	38	39	40	41	42	43	44	45	46	47	18	19	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	157	158	159	160	161	162
3	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	151	152	153	154	155	156	187	188	189	190	191	192
4	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	145	146	147	148	149	150	181	182	183	184	185	186	211	212	213	214	215	216
5	109	110	111	112	113	114	115	116	117	118	119	120	139	140	141	142	143	144	175	176	177	178	179	180	205	206	207	208	209	210	229	230	231	232	233	234
6	121	122	123	124	125	126	133	134	135	136	137	138	169	170	171	172	173	174	199	200	201	202	203	204	223	224	225	226	227	228	229	242	243	244	245	246
7	127	128	129	130	131	132	163	164	165	166	167	168	193	194	195	196	197	198	217	218	219	220	221	222	235	236	237	238	239	240	247	248	249	250	251	252

FIG. 20

REFERENCE THRESHOLD

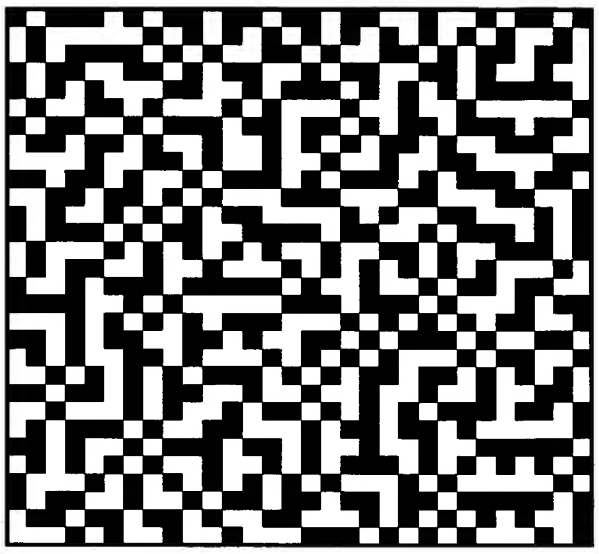
THRESHOLD PLANE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
2	37	38	39	40	41	42	43	44	45	46	47	18	19	50	51	52	53	54	55	56	57	58	59	60	97	98	99	100	101	102	103	104	105	106	107	108
3	61	62	63	64	65	66	67	68	69	70	71	72	85	86	87	88	89	90	91	92	93	94	95	96	133	134	135	136	137	138	139	140	141	142	143	144
4	73	74	75	76	77	78	79	80	81	82	83	84	121	122	123	124	125	126	127	128	129	130	131	132	169	170	171	172	173	174	175	176	177	178	179	180
5	109	110	111	112	113	114	115	116	117	118	119	120	157	158	159	160	161	162	163	164	165	166	167	168	205	206	207	208	209	210	211	212	213	214	215	216
6	145	146	147	148	149	150	151	152	153	154	155	156	193	194	195	196	197	198	199	200	201	202	203	204	229	230	231	232	233	234	235	236	237	238	239	240
7	181	182	183	184	185	186	187	188	189	190	191	192	217	218	219	220	221	222	223	224	225	226	227	228	241	242	243	244	245	246	247	248	249	250	251	252

FIG. 21A

REFERENCE THRESHOLD

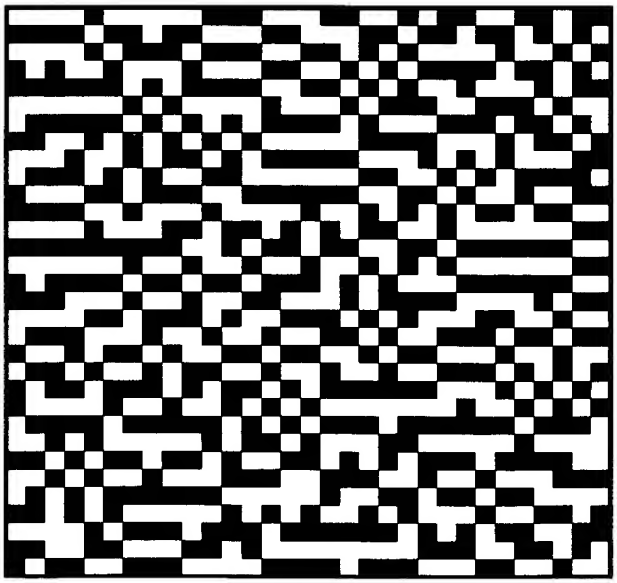
THRESHOLD PLANE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
2	37	38	39	40	41	42	43	44	45	46	47	18	19	50	51	52	53	54	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
3	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126
4	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162
5	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198
6	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234
7	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252

FIG. 21B



ANISOTROPIC

FIG. 22A



NON-ANISOTROPIC

FIG. 22B

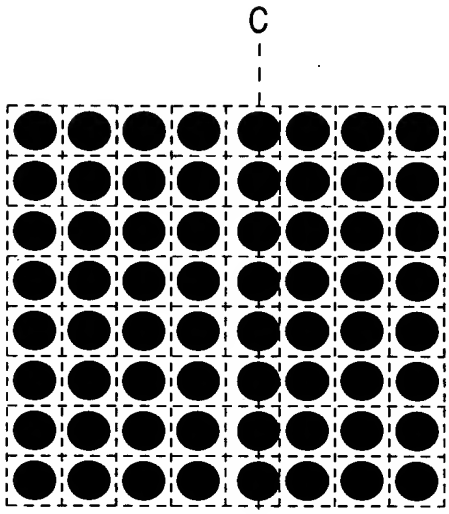


FIG. 23A

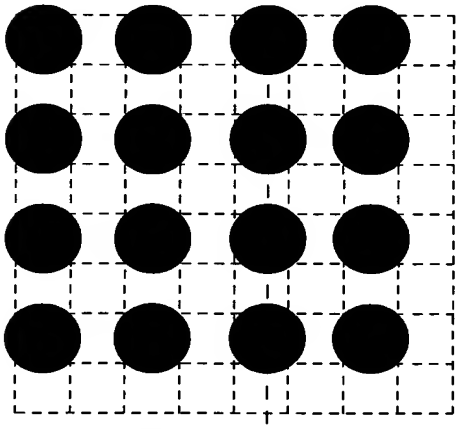


FIG. 23B

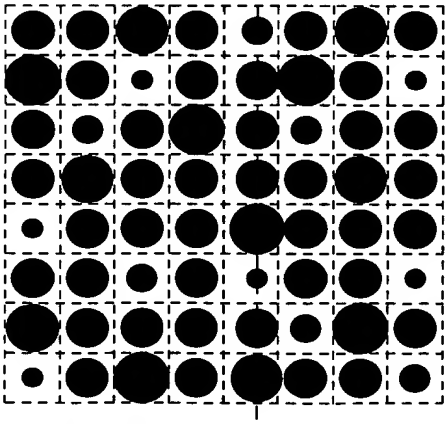


FIG. 23C

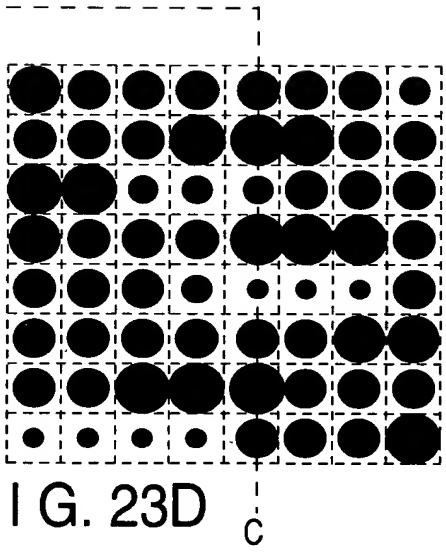


FIG. 23D

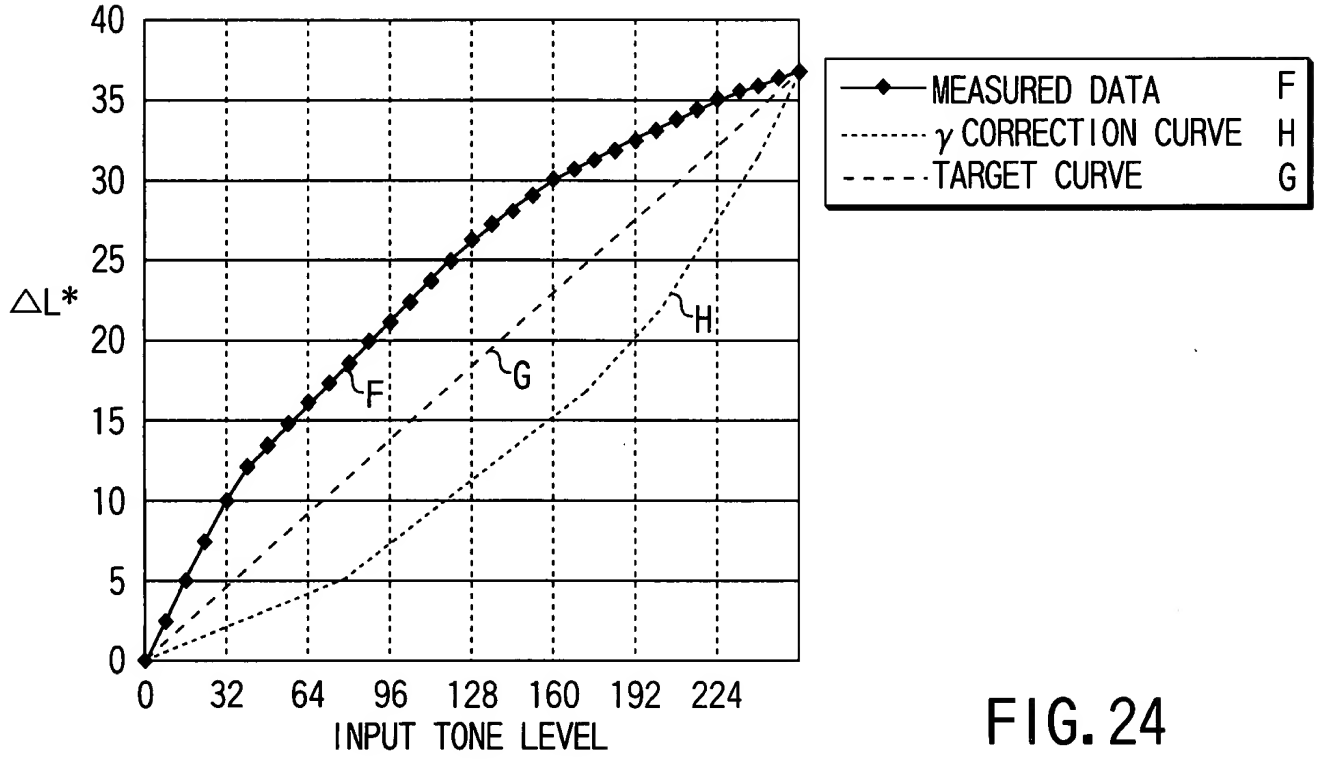

40
35
30
25
20
15
10
5
0
△L*
0
32
64
96
128
160
192
224
INPUT TONE LEVEL
F
G
H
MEASURED DATA
γ CORRECTION CURVE
TARGET CURVE

FIG. 24

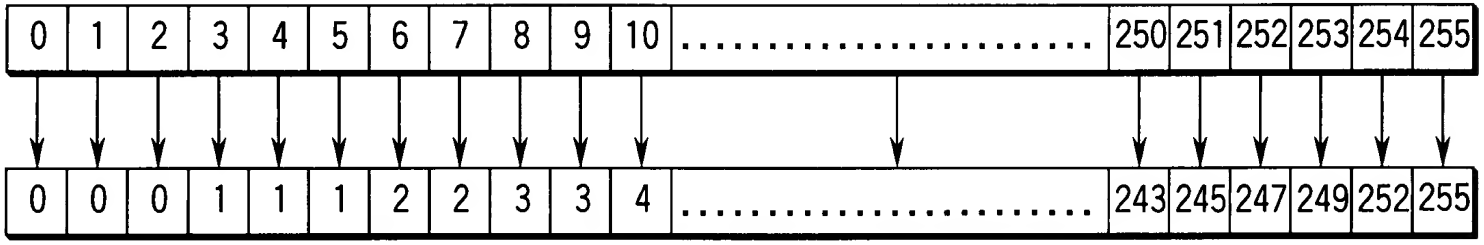

0 1 2 3 4 5 6 7 8 9 10 ..... 250 251 252 253 254 255
0 0 0 1 1 1 2 2 3 3 4 ..... 243 245 247 249 252 255

FIG. 25

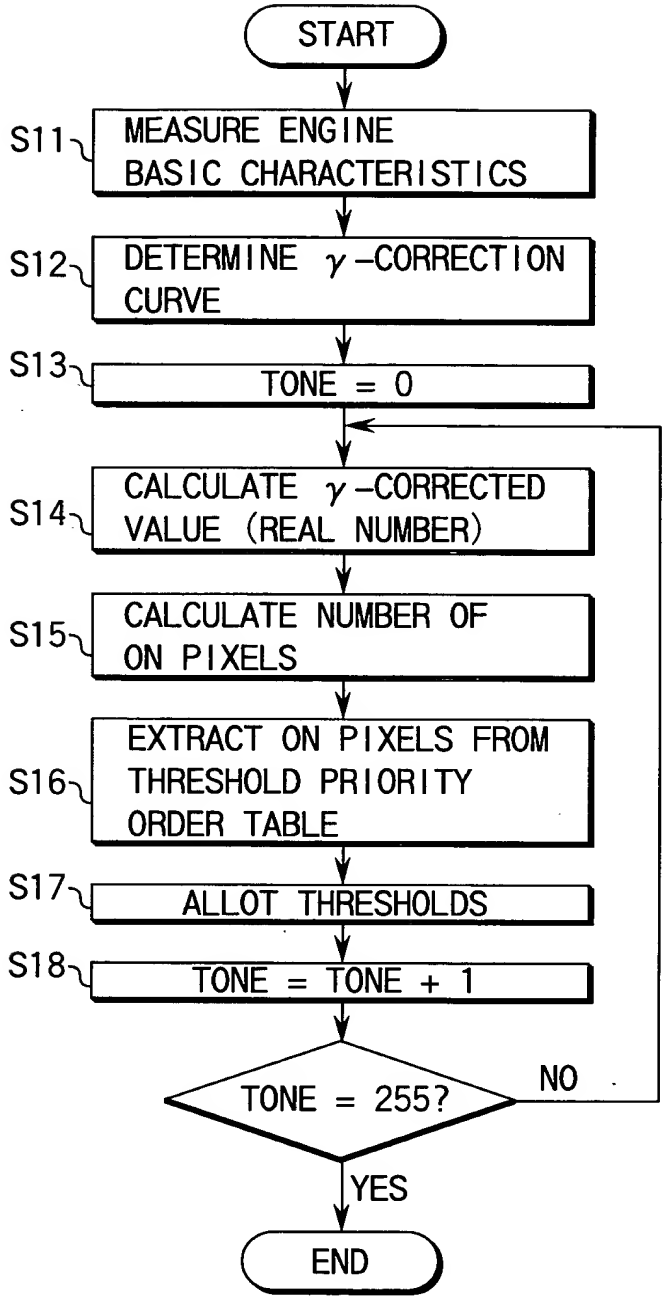


FIG. 26A

INPUT VALUE	0	1	2	3	4	5	6	7
BEFORE γ CORRECTION	0	4	4	4	4	4	4	4
AFTER γ CORRECTION (ACTUAL NUMBER)	0	0.6	1	1.5	2	2.8	3.8	5
ON NUMBER (INTEGER)	0	2	2	2	2	3	4	4

FIG. 26B

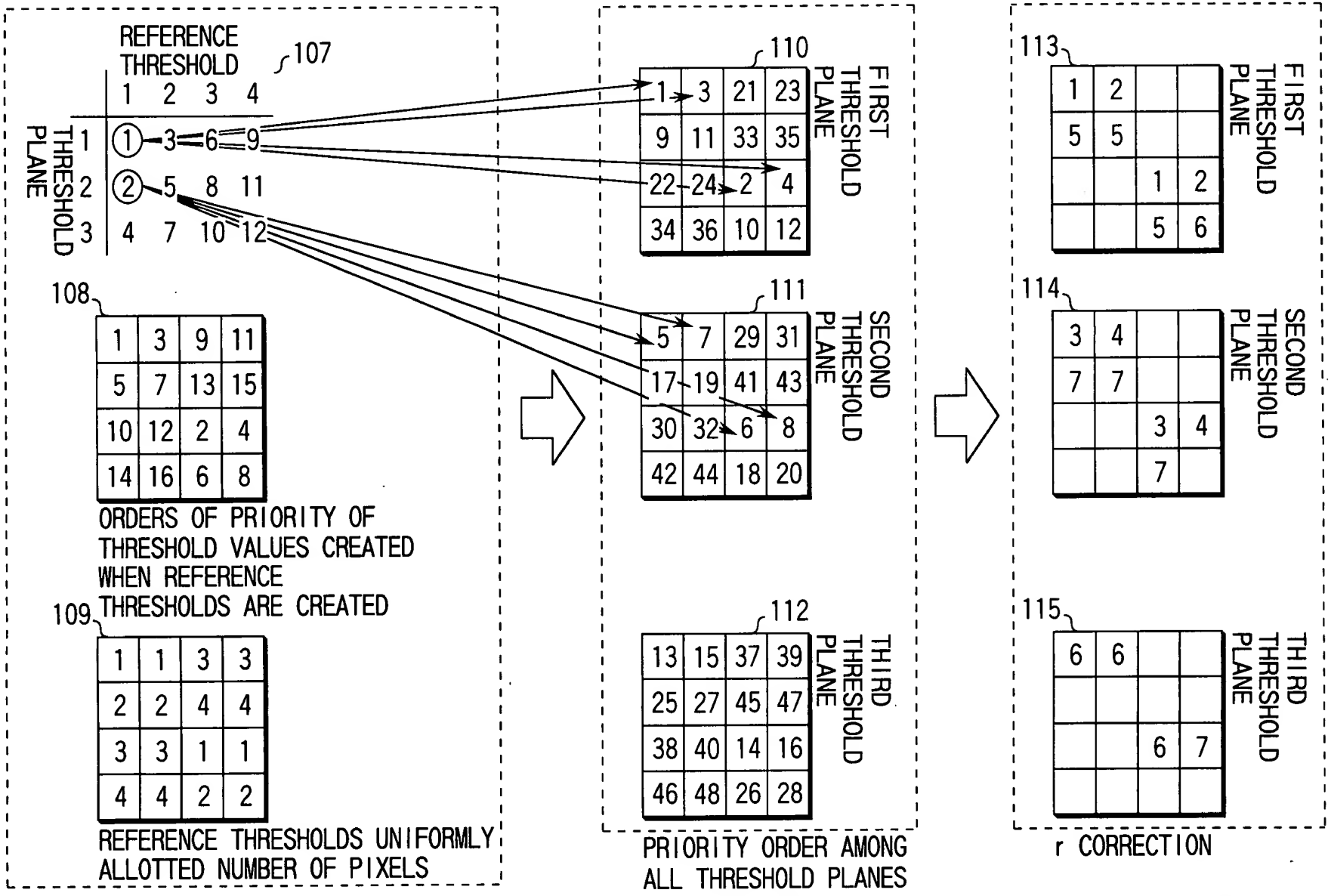


FIG. 27A

FIG. 27B

FIG. 27C

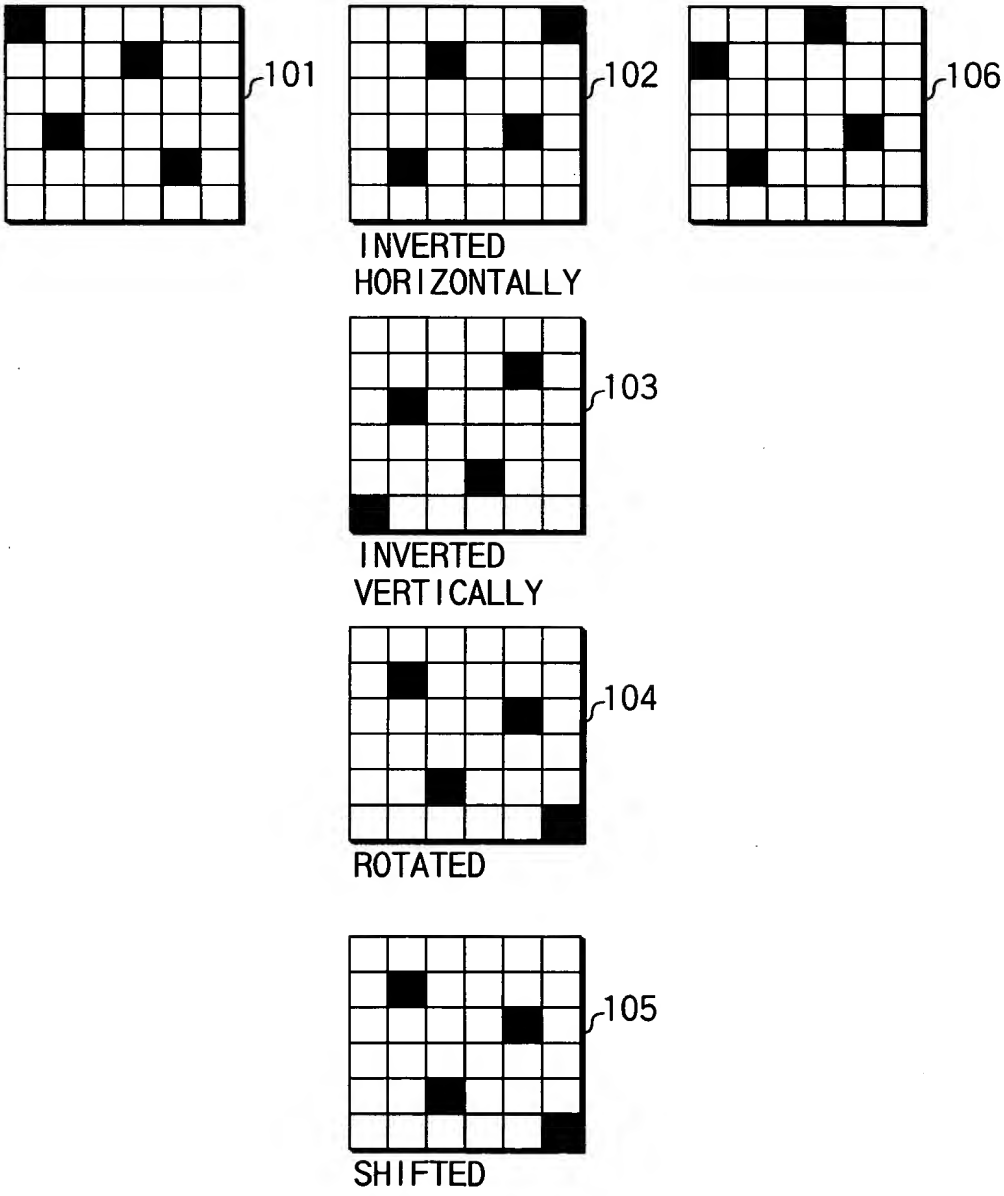

101
102
106
INVERTED
HORIZONTALLY
103
INVERTED
VERTICALLY
104
ROTATED
105
SHIFTED

FIG. 28

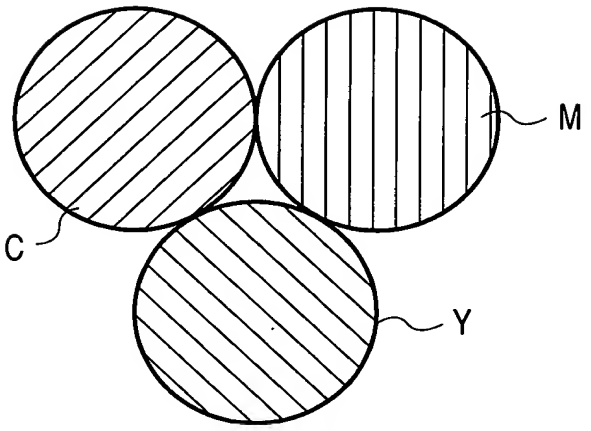


FIG. 29A

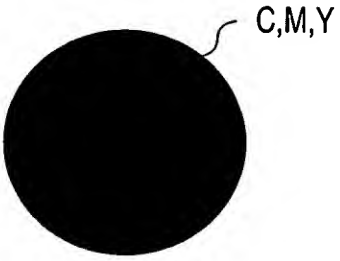


FIG. 29B

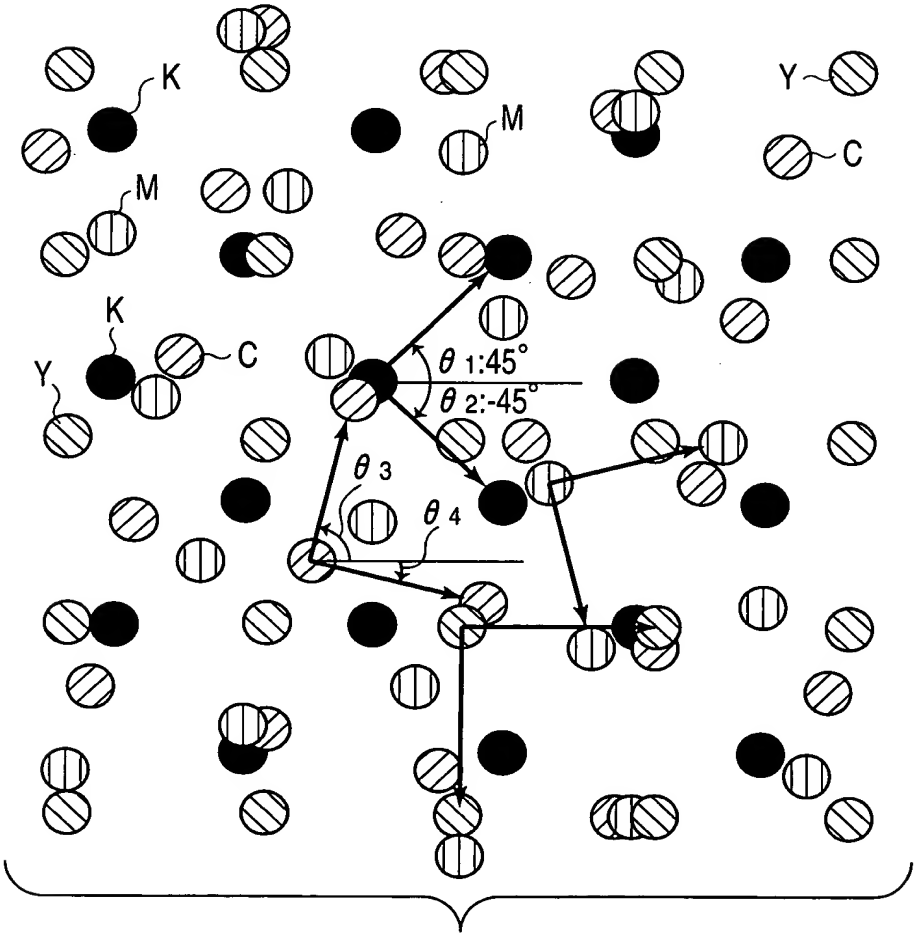
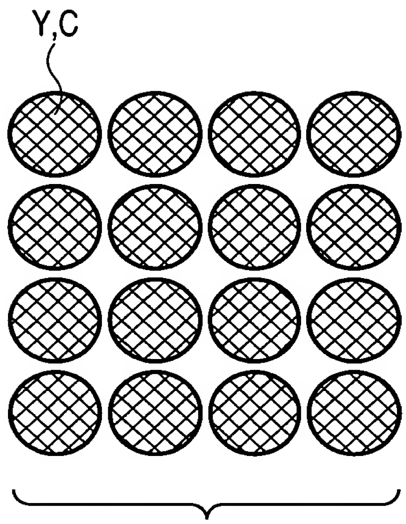
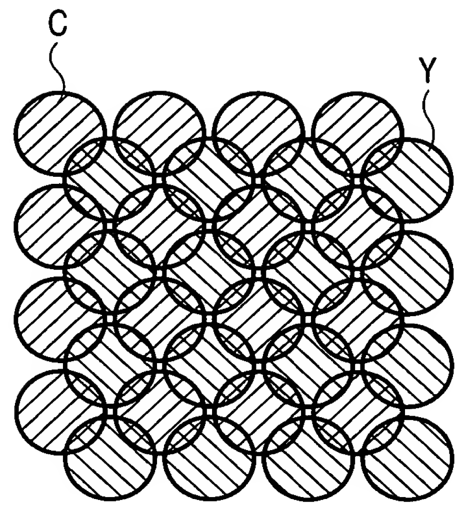


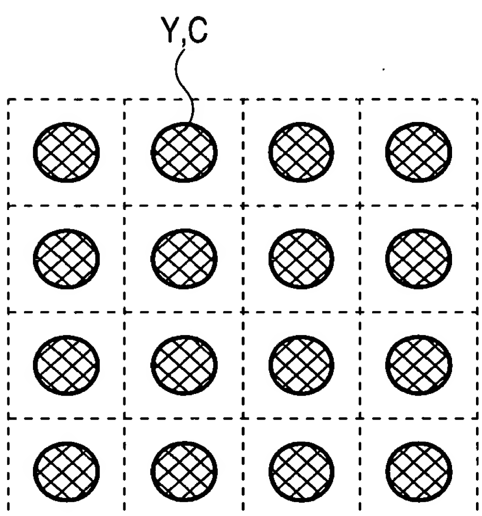
FIG. 30



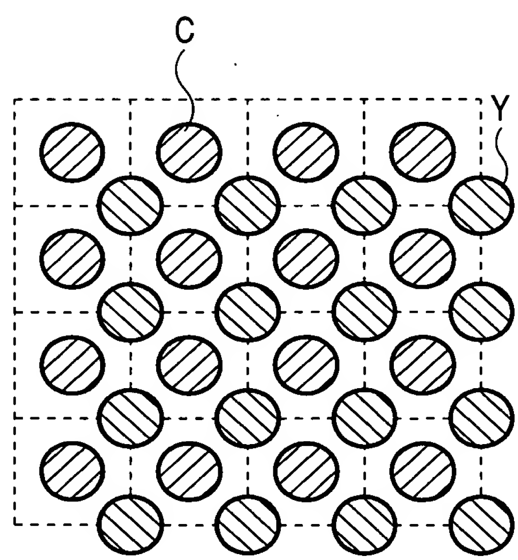
F I G. 31A



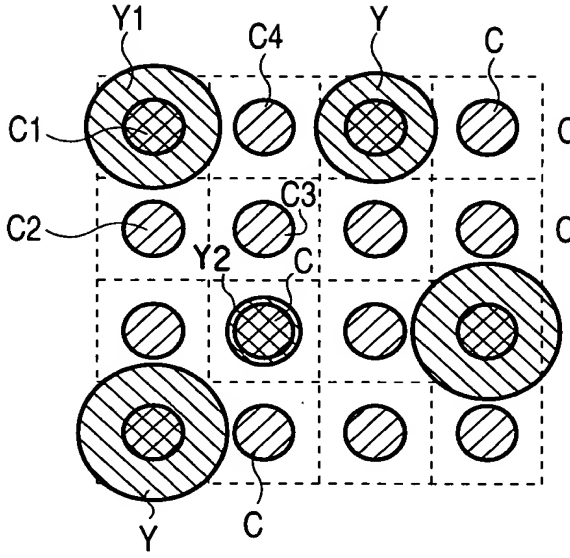
F I G. 31B



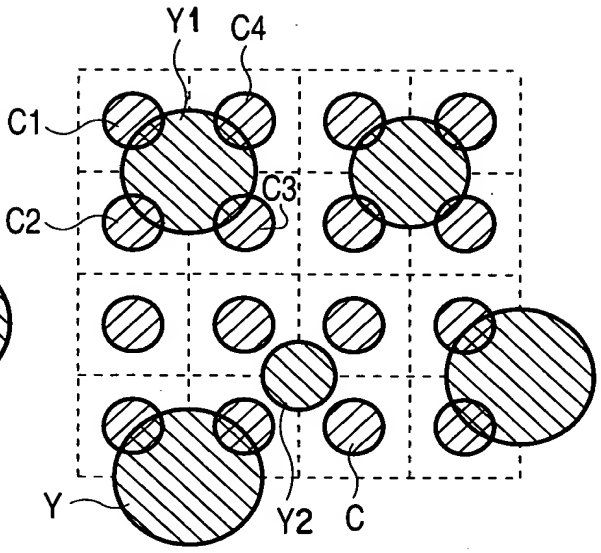
F I G. 32A



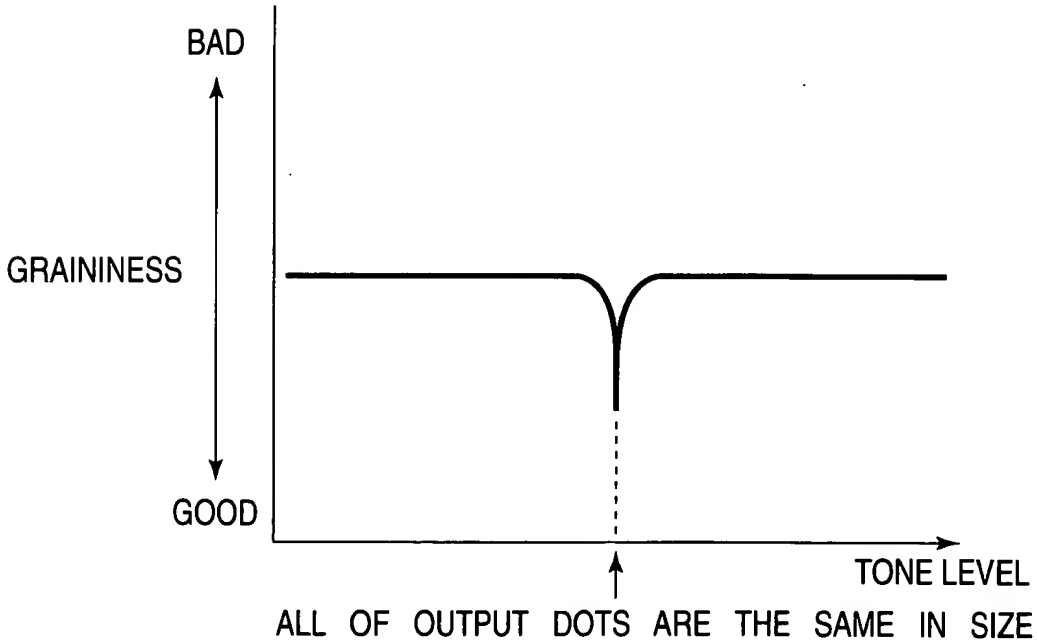
F I G. 32B



F I G. 33A



F I G. 33B



F I G. 34

FIG. 35A

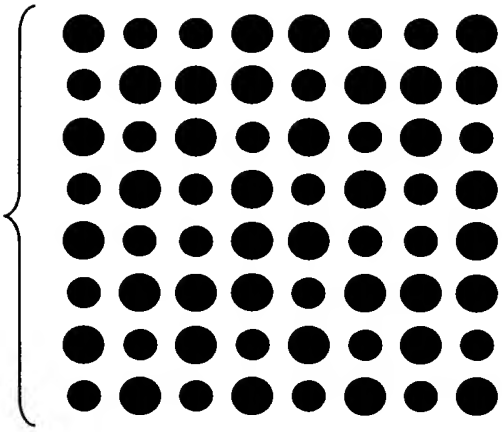


FIG. 35B

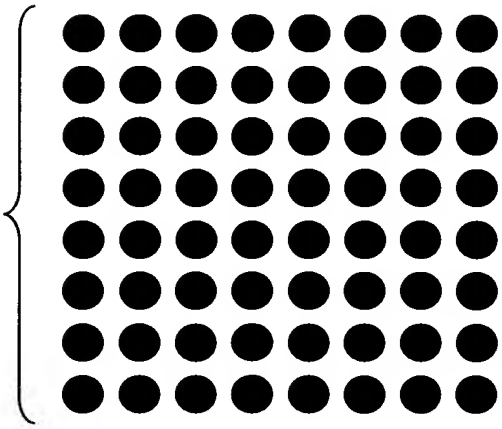


FIG. 35C

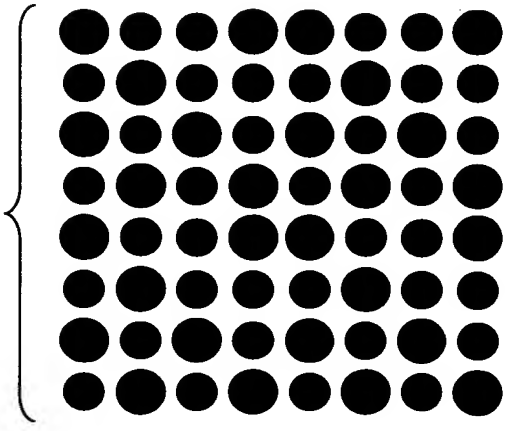


FIG. 36A

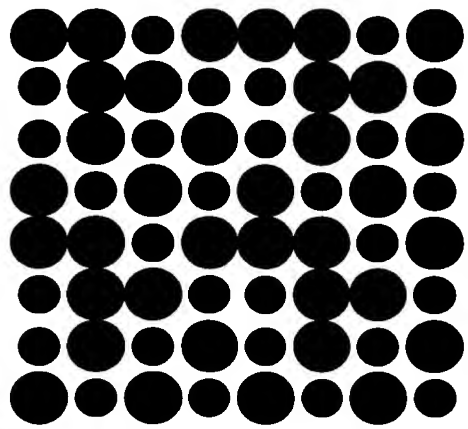


FIG. 36B

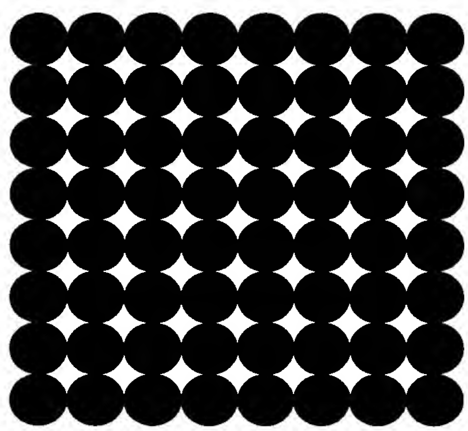
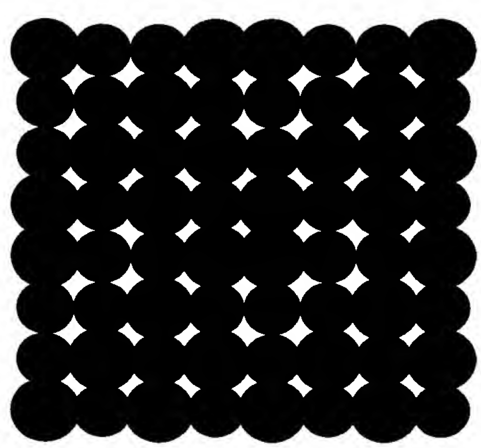


FIG. 36C



THRESHOLD PLANE	REFERENCE THRESHOLD							
	1	2	3	4	5	6	7	8
1	1	2	3	4	5	6	9	10
2	7	8	11	12	13	14	17	18
3	15	16	19	20	21	22	25	26
4	23	24	27	28	29	30	33	34
5	31	32	35	36	37	38	41	42
6	39	40	43	44	45	46	49	50
7	47	48	51	52	53	54	55	56

FIG. 37A

THRESHOLD PLANE	REFERENCE THRESHOLD							
	1	2	3	4	5	6	7	8
1	1	2	3	4	5	9	10	11
2	6	7	8	12	13	17	18	19
3	14	15	16	20	21	25	26	27
4	22	23	24	28	29	33	34	35
5	30	31	32	36	37	41	42	43
6	38	39	40	44	45	49	50	51
7	46	47	48	52	53	54	55	56

FIG. 37B

THRESHOLD PLANE	REFERENCE THRESHOLD							
	1	2	3	4	5	6	7	8
1	1	2	3	4	5	6	7	9
2	8	10	11	12	13	14	15	17
3	16	18	19	20	21	22	23	25
4	24	26	27	28	29	30	31	33
5	32	34	35	36	37	38	39	44
6	40	42	43	44	45	46	47	49
7	48	50	51	52	53	54	55	56

FIG. 37C

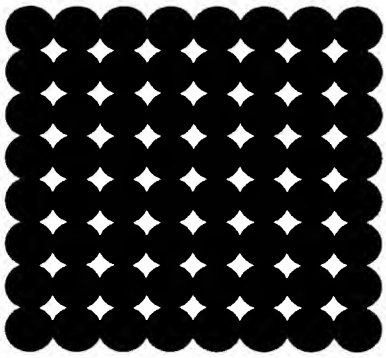


FIG. 38A

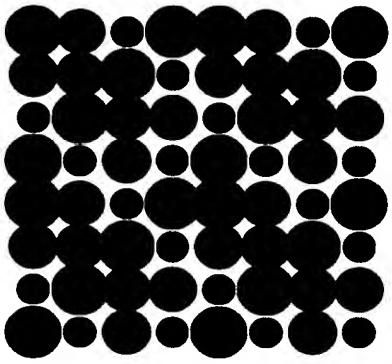


FIG. 38B

REFERENCE THRESHOLD

THRESHOLD PLANE	1	2	3	4	5	6	7	8
1	1	2	3	4	5	6	15	16
2	7	8	11	12	13	14	23	24
3	9	10	19	20	21	22	31	32
4	17	18	27	28	29	30	39	40
5	25	26	35	36	37	38	47	48
6	33	34	43	44	45	46	53	54
7	41	42	49	50	51	52	55	56

FIG. 39A

REFERENCE THRESHOLD

THRESHOLD PLANE	1	2	3	4	5	6	7	8
1	1	2	3	4	5	9	10	12
2	11	13	14	15	16	17	18	20
3	19	21	22	23	24	25	28	29
4	26	27	30	31	32	33	36	37
5	34	35	38	39	40	44	45	46
6	41	42	43	47	48	52	53	54
7	49	50	51	55	56	57	58	59

FIG. 39B

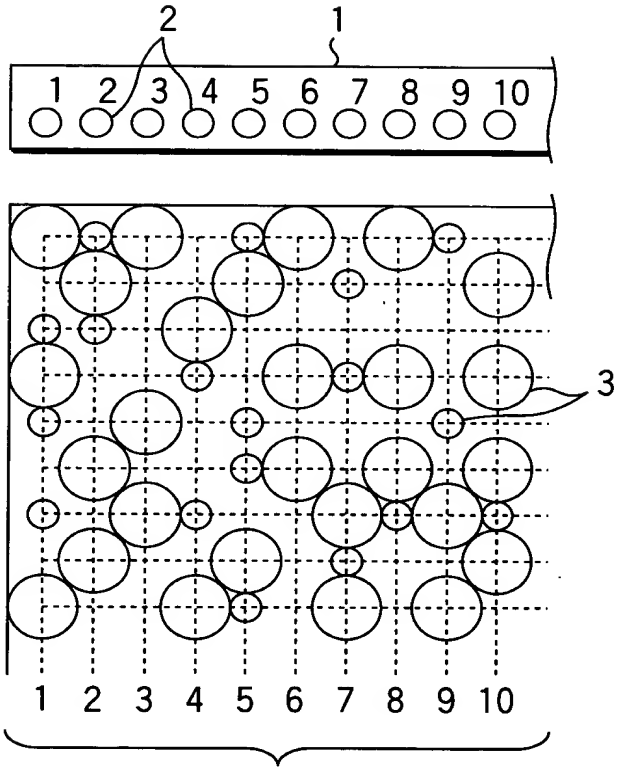


FIG. 40

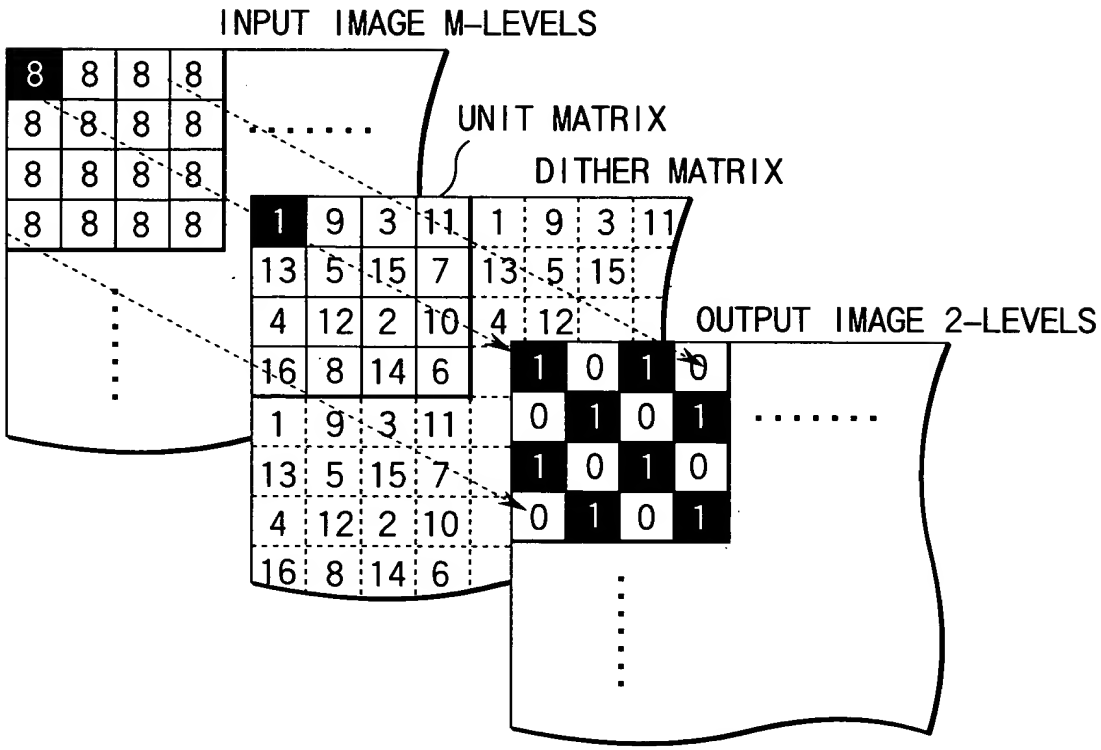

INPUT IMAGE M-LEVELS
UNIT MATRIX
DITHER MATRIX
OUTPUT IMAGE 2-LEVELS

FIG. 41

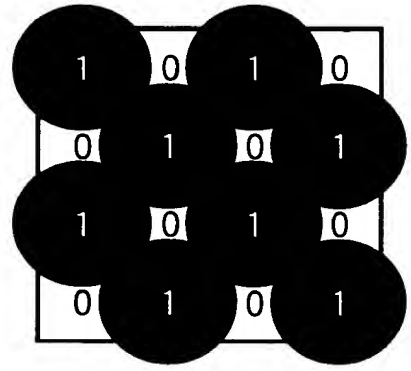

BI-LEVEL OUTPUT PATTERN

FIG. 42

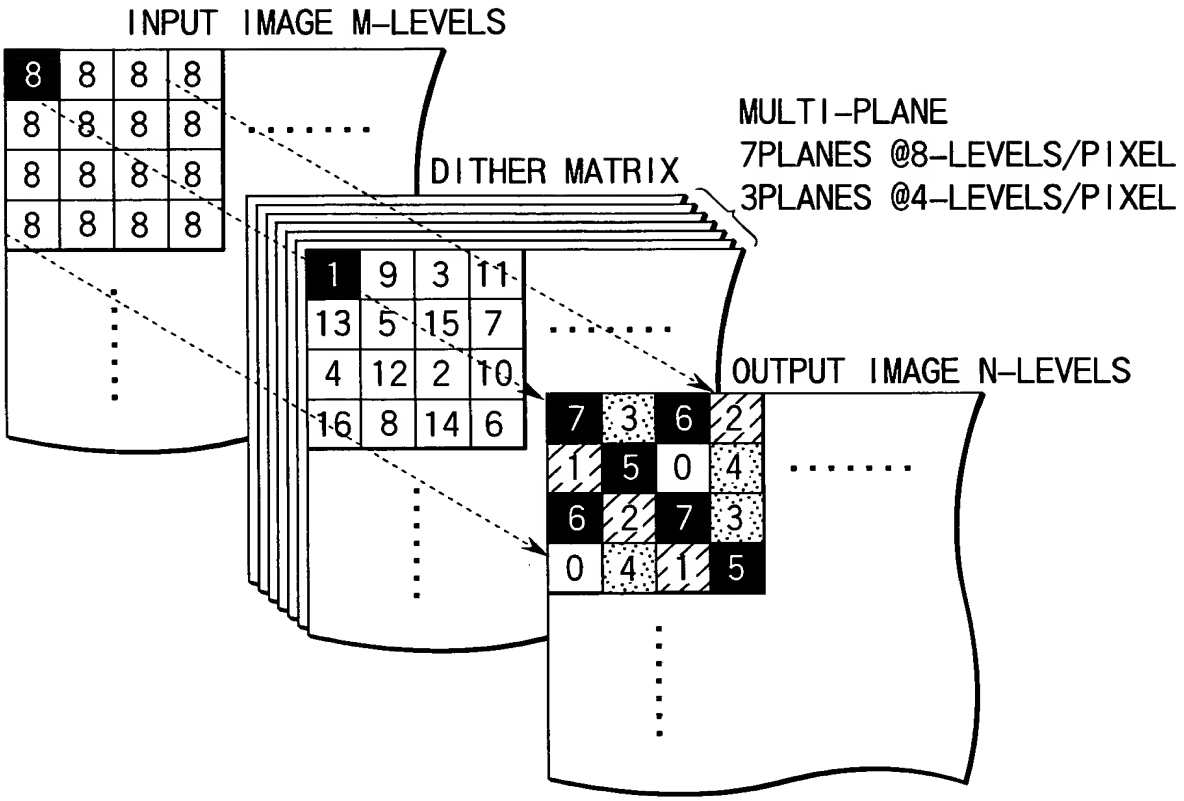

INPUT IMAGE M-LEVELS
8 8 8 8
8 8 8 8
8 8 8 8
8 8 8 8
DITHER MATRIX
MULTI-PLANE
7PLANES @8-LEVELS/PIXEL
3PLANES @4-LEVELS/PIXEL
1 9 3 11
13 5 15 7
4 12 2 10
16 8 14 6
OUTPUT IMAGE N-LEVELS
7 3 6 2
1 5 0 4
6 2 7 3
0 4 1 5

FIG. 43

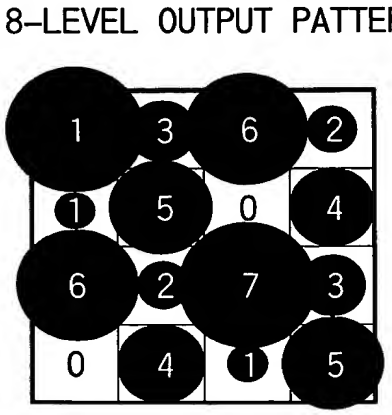

8-LEVEL OUTPUT PATTERN
1 3 6 2
1 5 0 4
6 2 7 3
0 4 1 5

FIG. 44

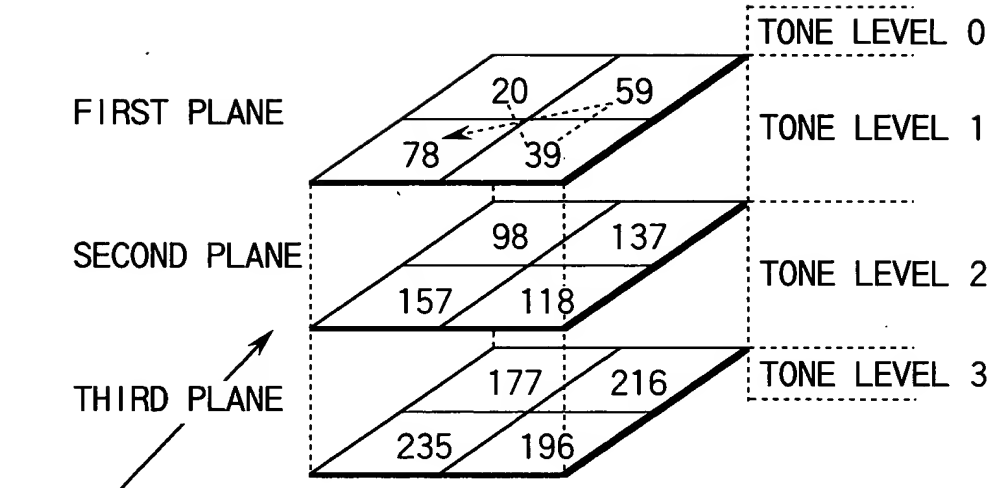
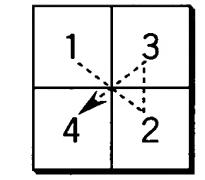


FIG. 45A



REFERENCE THRESHOLD ARRAY

FIG. 45C

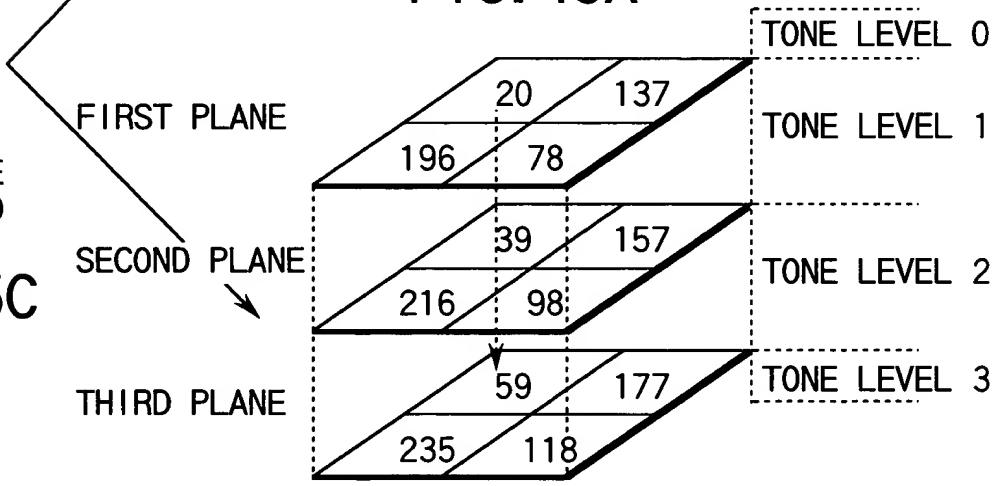


FIG. 45B

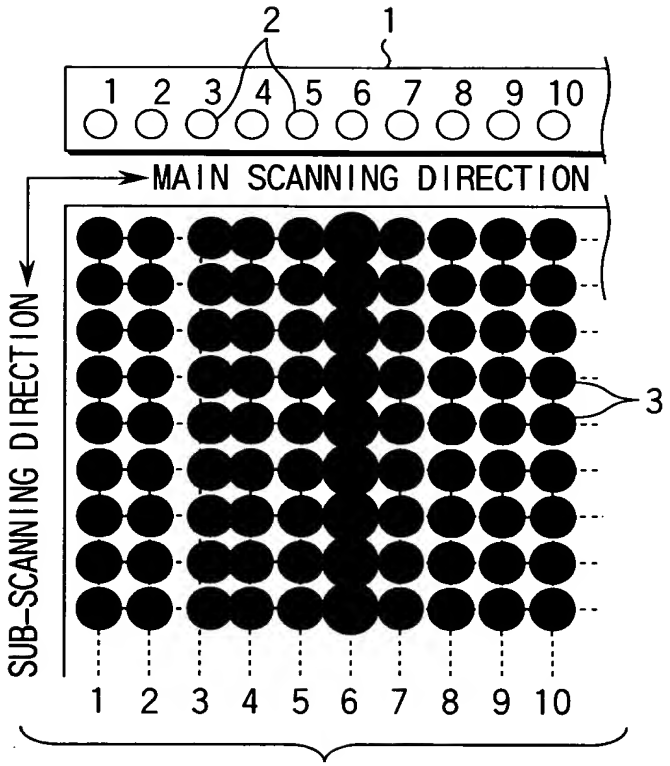

2
1
1 2 3 4 5 6 7 8 9 10
MAIN SCANNING DIRECTION
SUB-SCANNING DIRECTION
3
1 2 3 4 5 6 7 8 9 10

FIG. 46